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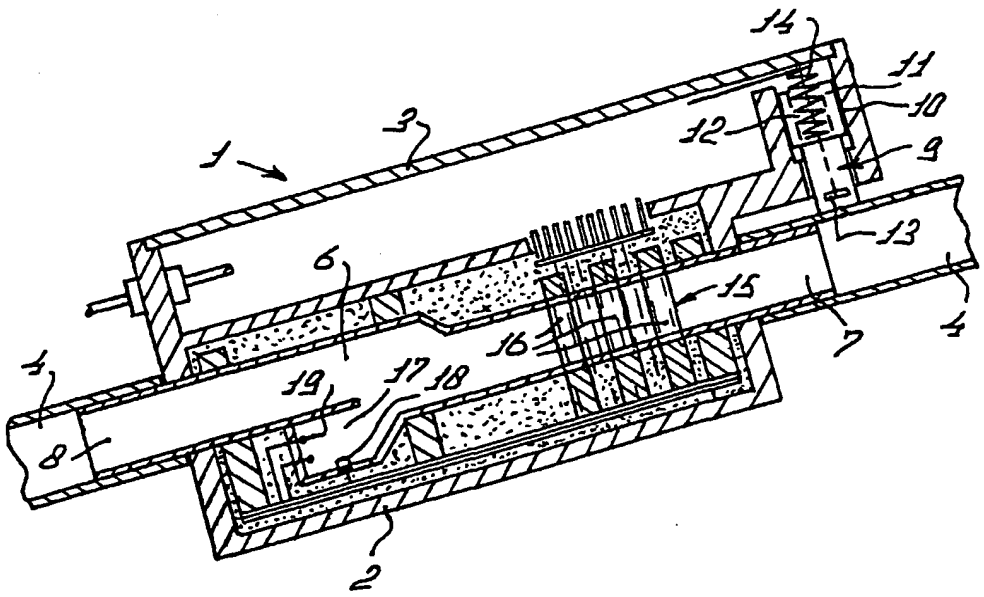
(54) Title: METHOD AND DEVICE FOR MEASUREMENT OF PULSATING MILK FLOW



(57) Abstract: The invention relates to a method of carrying out, in a line, (4; 6, 23) measurements on a medium, especially constituted by a gas and/or a liquid, flowing - in particular in a pulsating current - through said line, which line (4; 6, 23) comprises a measuring region (17; 23) in which at least one parameter of the medium is determined during a measurement, so that there is defined an optimal measuring window in which the parameter is measured and the data from the measuring window are recorded and/or used for a further process.

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METHOD AND DEVICE FOR MEASUREMENT OF PULSATING MILK FLOW

The invention relates to a method of carrying out, in a line, measurements on a medium, especially constituted by a gas and/or a liquid, flowing - in particular in a pulsating current - through said line, which line comprises a measuring region in which at least one parameter of the medium is determined during a measurement.

Such a method is known.

In the known method measured values of the relevant parameter are continuously collected. Especially when the gas and/or liquid does not move through the line in a continuous flow, it is possible that certain parameter values are not representative. For the purpose of discerning non-usable measured values from usable measured values, various filter techniques are applied for separating usable measured values from the measured values collected. It has been found that filtering these measurement data is time-consuming and does not always produce the desired effect.

Therefore, the invention aims at obviating the above-mentioned drawback or minimizing same.

In accordance with the invention, this is achieved in defining an optimal measuring window in which the parameter is measured and whereby the data from the measuring window are recorded and/or used for a further process. In this manner only the usable measurement data, i.e. those measurement data having a high reliability, are recorded and/or used as a parameter in a further process.

According to an inventive feature, for the purpose of defining the measuring window, the moments are determined when a first pulse flow has passed the measuring region and when a next pulse flow is going to enter the measuring region. The above-mentioned method has the advantage that, during measuring, the measuring region is not affected by the flowing medium. In a preferred embodiment of the invention, the

measuring window is defined by the moment when, just before a new pulse flow enters the measuring region, the momentary measurement data of the relevant parameter are recorded and/or supplied as a control signal for a further process. The latter method has the advantage that at the moment of measuring the medium in the measuring region has had its longest period of rest. In the case that the medium is e.g. constituted by milk which is obtained by means of a milking installation, air bubbles entering the milk during milking have the opportunity to escape from the milk, so that measurement is not affected by these air bubbles.

In accordance with another method of the invention, it is also possible to define the measuring window at the moment when the largest possible amount of the medium is present in the measuring region. By the largest possible amount of the medium is meant that the volume of the medium is largest in the measuring region. According to a further inventive feature, the measuring window is defined by determination of the conductivity of the medium. By means of a conductivity measurement it is possible to ascertain whether the medium is present in a certain region of the line and it is also possible to determine the volume of the medium in said region. Besides a conductivity measurement, according to another inventive feature, the measuring window can also be defined by optical or acoustic detection. The above-mentioned method of detecting the medium is especially suitable when the medium flows through the line in a pulsating current. In the case that a medium flows through the line in a pulsating current, according to the invention, it is also possible to define the measuring window on the basis of signals that are supplied by means which generate the pulsating current. Such a signal comprises in particular the frequency of the pulsating current.

The invention also relates to a device for carrying out measurements on a flowing medium, in particular a medium which is flowing in a pulsating current, as described in the foregoing. According to an inventive feature, first measuring

means are disposed in the line of said device for determining the flowing medium as well as second measuring means with the aid of which at least one parameter of the medium is determined. According to again another aspect of the invention, the first measuring means comprise an optical and/or an acoustic and/or a conductivity sensor. According to a further inventive feature, it is possible that the first measuring means are constituted by a device by means of which the pulsating current of the medium is generated. In the case of a milk line system with a teat cup, the second measuring means are constituted by a pulsator.

According to a further aspect of the invention, the second measuring means comprise a colour sensor by means of which the colours of the medium are determined. Thus, in the case of a milking installation, it is possible to ascertain at a high degree of reliability whether the milk contains impurities, such as e.g. blood or pus. According to a further embodiment of the invention, the measuring region is situated in a bypass of the line through which the medium flows. Thereby the bypass is connected to the main line in such a manner that the medium comes to rest more or less in the bypass. According to another inventive feature, the diameter of the bypass is smaller than that of the line through which the medium flows. According to a further aspect of the invention, in or near the bypass there are disposed air inlet means with the aid of which air and/or an other gas is let in and/or injected into the bypass. In this manner replacement of the medium in the bypass is stimulated.

According to an inventive feature, the first and second measuring means are disposed in a milk line system or in a teat cup.

The invention will now be explained in further detail with reference to the accompanying drawing, in which:

Figure 1 is a cross-section of a milk line with various sensors included therein for measuring i.a. the quality of the milk;

Figure 2 is a plan view of the device depicted in Figure 1, and

Figure 3 is a cross-section of a teat cup which is provided with a bypass that is connected to the milk line.

Figure 1 is a cross-section of a sensor block 1 comprising a housing 2 which is covered with a lid 3. As shown in Figure 2, four milk lines 4 are connected to the sensor block 1 with a pulse line 5 disposed in between. Each of the milk lines 4 comprises a measuring tube 6 which is provided with an inflow opening 7 and an outflow opening 8. The measuring tubes 6 and the pulse line 5 are embedded in the housing 2. Near the inflow opening 7 there are disposed acoustic measuring means 9 with the aid of which it can be ascertained i.a. whether milk is flowing through the milk line 4 or whether a teat cup connected to the milk line 4 and coupled to or uncoupled from a teat of an animal to be milked is coupled or uncoupled. The acoustic measuring means 9 are disposed in a bore 10 of the housing 2. In the bore 10 there are disposed oval, foam plastic caps 11, each provided with a bore 12 with a mini-microphone 13 disposed therein. The mini-microphone 13 is pushed against the lower side of the bore 12 by means of a spring 14. Thus, the foam plastic caps 11 are pushed against the milk lines 4 under spring pressure. In the measuring tube 6 there is further included a milk conductivity sensor 15. The milk conductivity sensor 15 comprises three spaced apart measuring rings 16. The acoustic measuring means 9 and/or the milk conductivity sensor 15 constitute first measuring means for establishing the pulsating current of the milk.

The measuring tube 6 is further provided with a measuring chamber 17 in which milk remains after a pulse flow of milk has moved through the measuring tube 6. In the measuring chamber 17 there is disposed a colour sensor 18 by means of which the milk can be analysed for colour. In the measuring chamber 17 there is further provided a second milk conductivity sensor 19 by means of which the absolute milk

conductivity of the milk can be established. The colour sensor 18 and/or the second milk conductivity sensor 19 constitute the second measuring means with the aid of which at least one parameter of the milk can be determined. For the purpose of carrying out a proper measurement in the measuring chamber 17, the sensor block 1 is arranged at an angle of approximately 40° relative to the horizontal. During milking the first measuring means 9, 15 supply a signal indicating that a pulse flow of milk enters the measuring tube 6, on the basis of which signal the measured values being determined at that moment by the second measuring means 18, 19 are recorded as usable measurement data or used for a further process.

Figure 3 shows a second embodiment of the invention, in which it is also possible to obtain measurement data at a high degree of reliability. Figure 3 shows a cross-section of a teat cup 20 comprising a cylindrical outer jacket 21 with a teat cup liner 22 included therein. To the cylindrical outer jacket 21 there is connected a pulse line 5. Near the lower side of the outer jacket 21 there is further disposed the milk line 4. Said milk line 4 is provided with a bypass 23. The diameter of the bypass 23 is smaller than that of the milk line 4. On the teat cup liner 22 there is further disposed a movement sensor 24 by means of which the movements of the teat cup liner 22 are registered during milking. Near the lower side of the teat cup liner 22 in the pulsation space 25 there is further disposed a vacuum sensor 26 by means of which the alternating vacuum in the pulsation space 25 can be determined during milking. Near the lower side of the teat cup liner 22 there is included in the milk line 4 a milk conductivity sensor 15 which corresponds to the milk conductivity sensor of the first embodiment. The movement sensor 24 and the vacuum sensor 26 and the milk conductivity sensor 15 constitute the first measuring means with the aid of which the pulsating current of the milk is established. In the bypass 23 there are disposed second measuring means with the aid of which at least one parameter of the milk can be determined. In the present embodiment the second measuring means comprise a colour sensor

18 as disclosed in the first embodiment. It will be obvious, however, that, both in the first and the second embodiment, the second measuring means may also be constituted by different sensors than a colour sensor. The functioning of the second embodiment is as follows. When the first measuring means ascertain that a pulse flow of milk from the teat enters the milk line 4, the signal is immediately passed to the second measuring means, whereupon the second measuring means store the data being measured at that moment or use them as a parameter in a further process. Subsequently the pulsating current of the milk causes milk to flow through the milk line 4 as well as through the bypass 23, so that the milk in the bypass 23 is replaced. As a result of the fact that the diameter of the bypass 23 is smaller than that of the milk line 4 the rate of flow of the milk in the bypass 23 is lower than that in the milk line 4, so that the milk flow near the second measuring means is stabilized more quickly. This enables to carry out measurements at a high degree of reliability.

In the bypass 23 there are further disposed air inlet means 27 which communicate with the atmosphere. In the present embodiment the air inlet means 27 are constituted by a bore.

CLAIMS

1. A method of carrying out, in a line (4; 6, 23), measurements on a medium, especially constituted by a gas and/or a liquid, flowing - in particular in a pulsating current - through said line, which line (4; 6, 23) comprises a measuring region (17; 23) in which at least one parameter of the medium is determined during a measurement, characterized in that there is defined an optimal measuring window in which the parameter is measured, and the data from the measuring window are recorded and/or used for a further process.

2. A method as claimed in claim 1, characterized in that, for the purpose of defining the measuring window, the moments are determined when a first pulse flow has passed the measuring region and when a next pulse flow is going to enter the measuring region (17; 23).

3. A method as claimed in claim 1 or 2, characterized in that the measuring window is defined by the moment when, just before a new pulse flow enters the measuring region, the momentary measurement data of the relevant parameter are recorded and/or supplied as a control signal for a further process.

4. A method as claimed in claim 1, characterized in that the measuring window is defined by the moment when the largest possible amount of the medium is present in the measuring region (17; 23).

5. A method as claimed in any one of the preceding claims, characterized in that the measuring window is defined by determination of the conductivity of the medium.

6. A method as claimed in any one of the preceding claims, characterized in that the measuring window is defined by optical and/or acoustic detection in the line (4; 6, 23).

7. A method as claimed in any one of the preceding claims, characterized in that, for the purpose of defining the measuring window, a signal is supplied by the means which generate the pulsating current.

8. A method as claimed in claim 7, characterized in that the signal comprises a pulsating current frequency.

9. A device for carrying out measurements on a flowing medium, in particular a medium which is flowing in a pulsating current, as disclosed in any one of claims 1 to 8.

10. A device as claimed in claim 9, characterized in that in the line (4; 6, 23) first measuring means (9; 15; 24; 26) are disposed for determining the flowing medium as well as second measuring means (18; 19) with the aid of which at least one parameter of the medium is determined.

11. A device as claimed in claim 10, characterized in that the first measuring means (9; 15; 24; 26) comprise an optical and/or an acoustic and/or a conductivity sensor.

12. A device as claimed in claim 10 or 11, characterized in that the first measuring means (9; 15; 24; 26) are constituted by a device by means of which the pulsating current of the medium is generated.

13. A device as claimed in any one of claims 10 to 12, characterized in that the second measuring means comprise a colour sensor (18) by means of which the colours of the medium are determined.

14. A device as claimed in any one of claims 9 to 13, characterized in that the measuring region is constituted by a measuring chamber (17) in which at least part of the gas and/or liquid remains temporarily.

15. A device as claimed in any one of claims 9 to 14, characterized in that the measuring region is situated in a bypass (23) of the line (4) through which the medium flows.

16. A device as claimed in claim 15, characterized in that the diameter of the bypass (23) is smaller than that of the line through which the medium flows.

17. A device as claimed in claim 15 or 16, characterized in that in or near the bypass (23) there are disposed air inlet means (27) with the aid of which air and/or an other gas is let in and/or injected into the bypass (23).

18. A device as claimed in any one of claims 9 to 17, characterized in that the first and second measuring means are disposed in a milk line system.

19. A device as claimed in any one of claims 9 to 18, characterized in that that the first and/or second measuring means are disposed in a teat cup.

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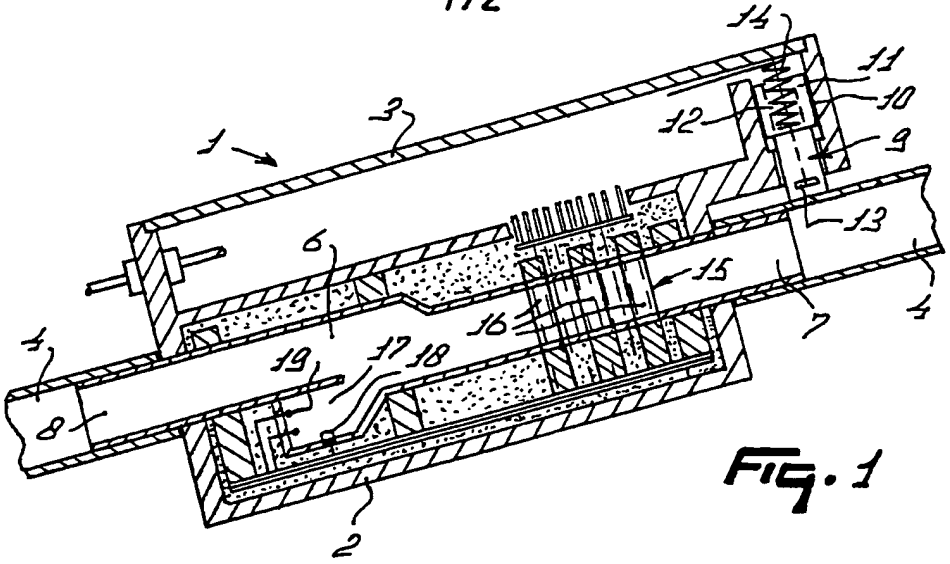

Fig. 1

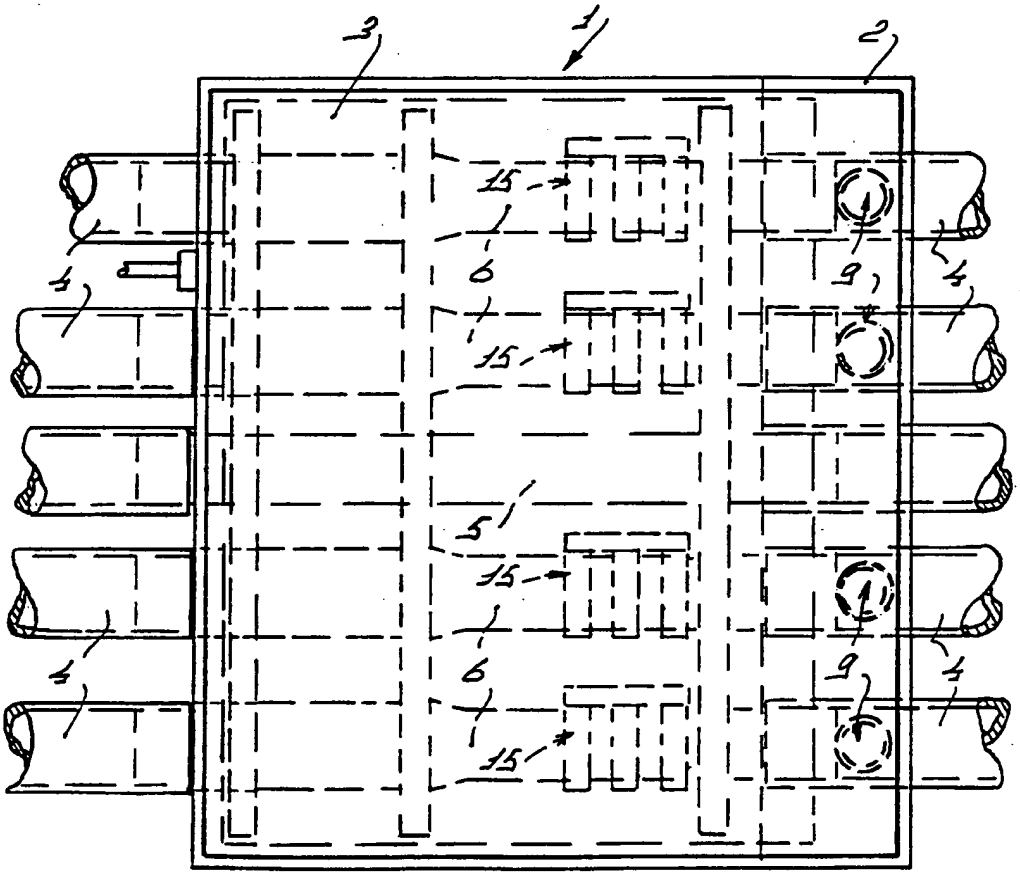

Fig. 2

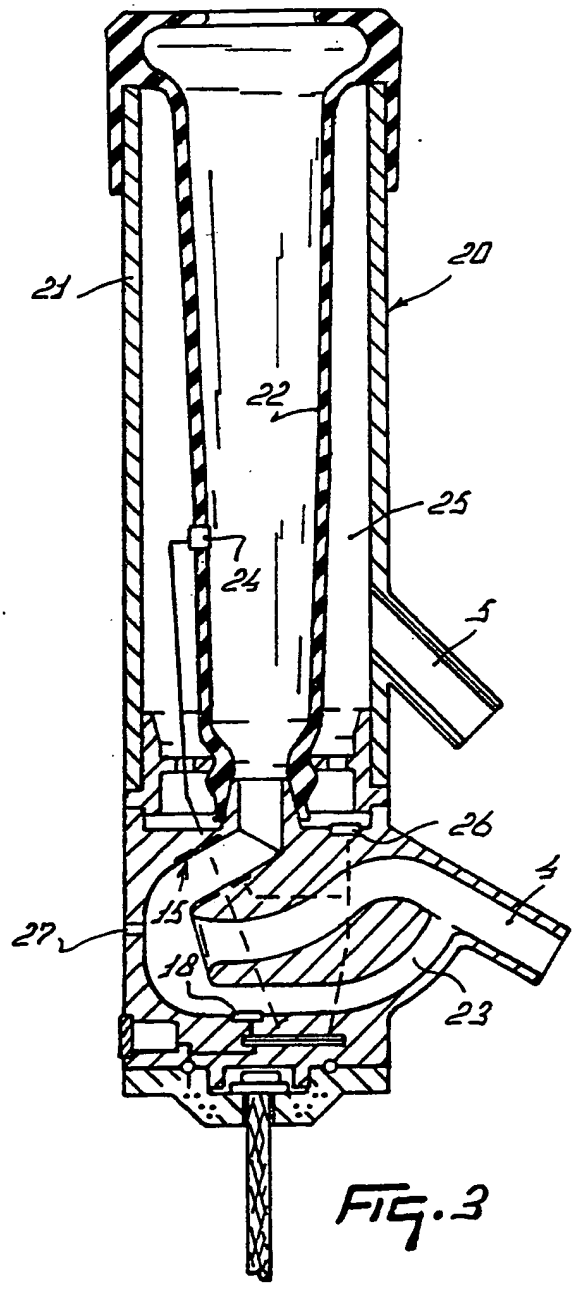

FIG. 3

INTERNATIONAL SEARCH REPORT

Inte ional Application No
PCT/NL 00/00620

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01F1/72 G01F1/74 A01J5/01 G01F3/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G01F A01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 654 551 A (WATT JOHN STANLEY ET AL) 5 August 1997 (1997-08-05)	1,2,4,9, 10
Y		5,11,14, 18,19
A	column 3, line 65 -column 5, line 43; figure 1	3

Y	EP 0 733 884 A (MAASLAND NV) 25 September 1996 (1996-09-25)	5,11,14, 18,19
A	column 3, line 54 -column 6, line 4; figures 2,3	1-4,9,10

A	EP 0 795 268 A (MAASLAND NV) 17 September 1997 (1997-09-17) the whole document	1,9

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
9 January 2001	15/01/2001

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte .ional Application No
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